

# PATENT SPECIFICATION

DRAWINGS ATTACHED

L109.501



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Date of filing Complete Specification: 5 Oct., 1964.

Application Date: 7 Oct., 1963.

No. 39462/63.

Complete Specification Published: 10 April, 1968.

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Index at acceptance: —B5 A(2E1A, 2E1B, 2E4A, 2E4G, 2E5, 2E9); E1 B(1A1A, 1E1A, 1E2A, 1F1B, 1F6, 1J2B2B)

Int. Cl.: —B 28 b 7/18

## COMPLETE SPECIFICATION

### Improvements in or relating to Moulds for Casting Blocks and Methods of Casting such Blocks

I, KANDIAH THARMA NAYAGAM, a Citizen of the Federation of Malaya, of c/o Zeno Limited, South Building, Kuala Lumpur, Malaya, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to moulds for casting blocks, particularly building blocks, and to methods of casting such blocks.

According to this invention in one aspect there is provided a mould, for casting a block on a horizontal floor, including a frame having upstanding side walls for defining boundaries of the block on the floor, and one or more formers extending across the frame for forming a passage or passages through the block, the or each former comprising two channel section members which are arranged together so as to form a tube, there being provided within the tube an expanding device comprising two parallel elongated elements extending along the length of the tube adjacent opposite sides thereof, and means connecting the elements in such a manner that they may be urged apart whilst being maintained in parallel relationship, the elements being so shaped as to engage parts of the channel section members in a manner to separate them, thereby expanding the tube, as the elements are urged apart, the elements also having parts arranged to engage the internal surface of the expanded tube, and support the wall thereof, along substantially the whole of its length.

According to the invention in another aspect there is provided a method of casting a block with one or more passages therein comprising pouring material which is capable of setting into a mould as set forth in the preceding paragraph positioned on a substantially hori-

zontal floor, allowing the material to set, and then removing the frame, collapsing and removing the former or formers and removing, where provided, core member or members.

The invention further includes a block when cast in a mould as set forth in the second paragraph of this statement or when cast by a method as set forth in the third paragraph of this statement.

In the mould, the former or at least one of the formers may have mounted externally thereon one or more core members for forming an aperture or apertures opening to the passage formed by the former. The former or formers may conveniently be located in holes in the frame and can be inserted and removed through said holes. For example, the or each former may be located at one end in said holes and have its other end engaged by a rod mounted on a sidewall of the frame which rod projects lengthwise of the former.

The invention will now be described in more detail with reference, by way of example, to the accompanying drawings, in which:

Figures 1 to 4 show various jointed blocks viewed in plan, which blocks can be made according to this invention,

Figure 5 is a perspective view of a mould in preparation for casting a block,

Figure 6 is a transverse section through a former in its expanded position,

Figure 7 is a transverse section through the former of Figure 6 in its collapsed position,

Figure 8 is a longitudinal section through part of the former of Figure 6,

Figure 9 is a plan of the expanding device of the former of Figure 6,

Figure 10 is a transverse section through cast blocks in their mould, and

Figure 11 is a transverse section through further cast blocks in their mould.

[Price 4s. 6d.]

In Figure 1, two blocks 11, 12 are jointed together end to end. Each block has a vertical channel 13 at each end and a number of vertical passages 14 intermediate its ends, the end channel 13 of each being substantially semi-circular, and the adjacent passages 14 being substantially hexagonal. The ends of the blocks are indicated at 15. A reinforcing grid 16 has been cast in the end of each block and the two reinforcing grids encircle the circular passage between the blocks. Some of the rods of each grid extend beyond the transverse plane through the centre of curvature of the end channel at 17.

The cut-away blocks 11, 12 are placed end to end so that the two channels 13 lie mouth to mouth, forming between them a substantially circular chamber 18. The reinforcing rods 16 from each block extending beyond the block form loops in the end channel of the other block. The two blocks are placed in this position on a base and a reinforcing rod 19 is placed substantially in the centre of the chamber 18. A concrete mix of suitable consistency is poured into the chamber 18 and allowed to set.

When the settable material has set in the chamber, it forms with the reinforcing rods a firm joint between the two blocks.

Figure 2 shows two blocks 21, 22 jointed together at their end passages 23 in an L-shape. One block 21 has a generally circular end passage and the second 22 has a generally hexagonal end passage. An opening 24 of approximately two thirds the diameter of the end passage of the first block is formed in the side of that opening, and a similar size opening 24 is formed in the end of the second block into the end passage of that block. A reinforcing wire loop 26 is placed on each reinforcing rod 21a or 22a of one of the blocks 21 or 22 and a reinforcing rod 27 is threaded through the loops 26 in the passage 23 of that one block. The blocks 21, 22 are placed together on a base with the openings 24 facing each other so that the end passages 23 and the openings 24 together form a chamber 25 to receive the concrete. A reinforcing rod 27 is then threaded through the loops 26 in the passage 23 of the other block. The concrete is poured into the chamber, and allowed to set. The concrete and the reinforcing rods 27 and loops 26 provide a strong joint between the two blocks 21, 22.

Figure 3 shows two blocks 31, 32 jointed together in the form of a T, the end of one block 31 being jointed to the other block 32 intermediate its ends. The first block 31 has an opening 33 formed in its end similar to that in the second block 22 shown in Figure 2, and the second block 32 has an opening 33 of similar size formed in the side communicating with a passage 34 intermediate its ends. The blocks 31, 32 are placed together on a base with the openings 33 side-by-side

and the joint is formed as described in relation to Figure 2. The block 32 has a main reinforcing grid 35 and a subsidiary grid 36 attached to the grid 35 and encircling the passage 34.

Figure 4 shows four blocks jointed cross-wise. Two blocks 41, 42 are formed with openings 43 in their ends similarly to the first block 31 of Figure 3. The other blocks 44, 45 are jointed end to end as described in Figure 1, but their end passages 46 are cut away beyond the level of the centre of their end passages, and they are placed together on a base leaving a gap 47 between the two blocks approximately equal in width to the openings 43 formed in the other blocks.

The first two blocks 41, 42 are placed with their openings 43 adjacent the gaps 47 between the third and fourth blocks 44, 45. The reinforcing loops 48 are inserted into the chamber 50 formed by the penetrated end passages of all four blocks before the last block closes the chamber. The rods 49 are inserted and the concrete poured in as described above.

A three-block joint can be formed in a similar way as described with reference to Figure 4, by leaving a gap 47 between the latter two blocks 44, 45 on one side only. Blocks with parallel passages running parallel to two sides of the block with their axes on the centre line of the block may be cast in a mould as shown in Figure 5. Two upstanding parallel steel channel side shutters 51, 52 are fixed in position on a horizontal floor 53. One side shutter 51 has a row of substantially hexagonal holes 54 formed along its length at six-inch centres, and the other side shutter 52 has a row of smaller circular short rods 57 bolted along its length at six-inch centres.

Formers 56, substantially hexagonal in section, are passed through the holes 54 in the first side shutter 51 and the rods 57 extending from the ends of the side shutter 52 pass into holes in the ends of the formers 56, so that the formers lie parallel to each other in a horizontal plane over the foundation 53. The former at or just beyond the position required for the end of the block has mounted upon it wooden core members 58 which extend below it to the horizontal foundation and above it to the upper level of the side shutters to act as an end shutter. The formers 56 will hereinafter be described in detail with reference to Figures 6 to 9, and the end shutter 58 with reference to Figures 10 and 11.

Figure 5 shows a mould in which some formers 56 have been placed in position and a further former 56a is being inserted. The Figure shows an intermediate shuttering 59 placed in the centre of the mould to form a window opening in the block when it is cast. The shuttering 59 is formed with holes to

receive the formers 56 so that standard length formers may be used along the whole length of the mould. Further reinforcing bars 61 are laid above and below the formers to strengthen the block around the window opening. A further shutter 62 is included for a switch box socket in the block.

Transverse welded grids of reinforcing rods 63 (Figures 10, 11) are laid on the formers 56, and the formers forming passages in the blocks which will be subject to greater stresses are encircled by the grids 63. These formers may be encircled by the ends of the grids 63 or by additional grids clipped on to the main grid, for example as shown at 36 in the second block 32 in Figure 3.

When all the formers 56 and reinforcing bars 61 and grids 63 have been laid in position, a concrete mix is poured into the mould. The mix is vibrated and levelled and a power tamper and screeder is used to give the desired finish to the upper horizontal surface of the block. The mix is allowed to set, being heat cured if rapid setting is required.

When the block has set, and the cores 58 are removed, all the formers 56 are collapsed and attached to a draw bar outside the first side shutter 51 and withdrawn simultaneously from the cast block. After the side shutters 51, 52 have been removed a suitable lifting device can be inserted through certain passages, and the cast block lifted from its horizontal foundation to store or to its required position as part of a building. If the lifting capacity of the device is insufficient for a large block, smaller blocks may be cast and lifted individually into position, being jointed together by joints illustrated in Figure 1 for example.

The formers 56 are formed from two channel members 71, 72 (Figures 6 to 9) held together mouth to mouth by an expanding link device 73 within the members. The sides of the channel members are inclined outwardly at about 60° to their base. Inside the free edges of the channel members 71, 72 bars are welded to act as internal lips 74. The link device 73 has two U-shaped members 75 linked together by a number of hinged links 76 in a parallelogram arrangement. The arms 77 of one U-shaped member 75 engage the lips 74 on one side of both channel members 71, 72 when placed mouth to mouth and those of the other U-shaped member 75 the lips 74 on the other side of the channel members 71, 72. A hardwood wedge-shaped strip 78 is mounted in the centre of each U-shaped member 75 to extend outwards between the arms 77. On either side the strip 78 has rubber filled sockets 79 to receive the lips 74.

The channel members 71, 72 are provided with strengthening ribs 81 welded in position at regular intervals, the member 71 having ribs across its whole base, and the member

72 having corner ribs only. The ribs 81 extend to approximately two-thirds the height of the members. The ends of the members are closed off by end plates 82, and a cover plate 83 at one end is welded to the inside of the end plate 82 of member 71. The cover plate 83 and end plates 82 are cut away at 84 to receive the short cylindrical rod 57.

The former 56 is assembled with the channel members 71, 72, mouth to mouth, the cover plate 83 attached to one member 71 abutting the inside of the end plate 82 of the other member 72. The link device 73 is inserted into the former 56 with its links 76 substantially parallel to the U-shaped members 75. The former is inserted through the holes 54 on to the rods 57.

The former 56 is expanded by moving one U-shaped member 75 relative to the other to incline the links 76 to the members 75. The U-shaped members 75 move away from each other and their arms 77 pass outside the lips 74 and the hardwood strip 78 urges the members away from each other. The lips 74 are received in the sockets 79. The former is now in its expanded position (Figure 6).

Before removal from the cast block, the former 56 is collapsed by withdrawing one U-shaped member 75 so that it approaches the other U-shaped member. The former is further collapsed by withdrawing the one member 71 from the other 72 so that the end plates 82 can overlap as shown in Figure 8.

Figure 10 shows a section parallel to the side shutters 51, 52 through two adjacent blocks in the shuttering shown in Figure 5 with the formers 56 removed. The end of one block 101 is shown with a reinforcing grid 63 encircling its end passage 103. The adjacent block 102 is shown with a circular end passage 104 and a reinforcing grid 63 looped around its end passage 104. Around the former position intermediate the two blocks a wooden core 105 has been built to shape the ends of the blocks 101, 102. The core 105 has a rectangular outer section and has an internal passage to receive the former 56 passing between the blocks. A bolt 106 secures the core 105 to the former passing through it.

The first block 101 is formed with an opening 107 in its end face communicating with its end passage. This opening is formed by a frusto-conical wooden core 108 held in position between the former forming the end passage 103 of the first block 101 and the core 105. This core 108 is removed from the cast block after removal of the former from its end passage 103 and of the core 105.

The second block 102 has an opening 109 formed in its side face into its end passage. This opening is formed by a frusto-conical wooden core 110 bolted to the former forming the end passage 104. This core 110 is removed from the cast block 102 before withdrawal of the former 56.

Both cores 108,110 are shaped to receive the rods of the reinforcing grids 63 of the two blocks 101,102.

The two blocks 101,102 shown in Figure 10 are now formed ready for jointing in the same way as shown with reference to blocks 21,22 in Figure 2. By casting the openings in the blocks it is possible to obtain openings which are accurately positioned and which are formed without cracks in the adjacent portions of the block. Cracks might occur if the openings were clipped out of a block cast without openings into its passages.

The end passage of the second block is cast as a circle of smaller cross-section than the normal hexagonal shape when additional wall thickness is required. For this purpose a circular former is used, fitted with a hexagonal adapter where it passes through the side shutter 51.

In order to cast blocks with openings extending to the transverse plane through the axis of the end passages, for example for the joint shown in Figure 1, a core 111 such as that shown in Figure 11 is used. This core 111 comprises two assemblies 112 shaped to extend substantially to the transverse plane through the axis of the end formers in two adjacent blocks 113,114 and to shut off the space between the formers. The two assemblies 112 are secured together by a bolt 115 passing between the two end formers. The assemblies are grooved to receive the reinforcing grids 63 wound around the end formers.

Cores of suitable shapes can be mounted on or between formers for moulding any required openings in the blocks. For example, a frusto-conical core is mounted on a former forming a passage between the ends of a block to form the opening in the second block of Figure 3; the assemblies shown in Figure 11 are extended when the gaps shown in Figure 4 are required.

The formers and cores may be formed with projections and recesses to locate the cores on the formers.

Where the block is to form a wall on which beams are to be supported, a region of additional strength is provided by locating the formers with their hexagonal sectional portions a suitable distance from the second side shutter 52, with a portion of the rod 57 extending between the end of the former and the side shutter 52. The portion of each rod 57 is sheathed by a rubber tube when being used as a former. For additional strength certain formers may be omitted, so that the block is cast without those passages, or certain passages may be filled with concrete after casting.

For blocks having passages at six inch centres, a reinforcing grid 63 of quarter inch diameter mild steel rods at six inch by fifteen inch centres is suitable.

Although the blocks have been described as rectangular, the mould can be modified to cast blocks of other shapes.

#### WHAT I CLAIM IS:—

1. A mould, for casting a block on a horizontal floor, including a frame having up-standing side walls for defining boundaries of the block on the floor, and one or more formers extending across the frame for forming a passage or passages through the block, the or each former comprising two channel section members which are arranged together so as to form a tube, there being provided within the tube an expanding device comprising two parallel elongated elements extending along the length of the tube adjacent opposite sides thereof, and means connecting the elements in such a manner that they may be urged apart whilst being maintained in parallel relationship, the elements being so shaped as to engage parts of the channel section members in a manner to separate them, thereby expanding the tube, as the elements are urged apart, the elements also having parts arranged to engage the internal surface of the expanded tube, and support the wall thereof, along substantially the whole of its length.

2. A mould as claimed in claim 1, wherein said parallel elements are connected together by links pivoted to said elements in such a manner that the links can be rotated to alter the distance between said elements.

3. A mould as claimed in claim 2, wherein said links are disposed parallel to each other.

4. A mould as claimed in any of claims 1 to 3 wherein each element is disposed adjacent the junction between a lengthwise-extending side edge of one of the channel section members and the adjacent lengthwise-extending side edge of the other of the members, the element being shaped to bridge the gap between those side edges as the channel-section members are separated.

5. A mould as claimed in claim 4, wherein each of said elements is wedge-shaped at its face which engages said side edges, so as to push the members apart to expand the former.

6. A mould as claimed in any of claims 1 to 5, wherein the former or at least one of the formers has mounted externally thereon one or more core members for forming an aperture or apertures opening to the passage formed by the former.

7. A mould as claimed in any of claims 1 to 6, wherein the former or formers is or are located in holes in the frame and can be inserted and removed through said holes.

8. A mould as claimed in claim 7 wherein the or each former is located at one end in said holes and has its other end engaged by a rod mounted on a sidewall of the frame which rod projects lengthwise of the former.

9. A mould as claimed in any of claims 1 to 8, wherein a plurality of said formers



Both cores 108,110 are shaped to receive the rods of the reinforcing grids 63 of the two blocks 101,102.

The two blocks 101,102 shown in Figure 10 are now formed ready for jointing in the same way as shown with reference to blocks 21,22 in Figure 2. By casting the openings in the blocks it is possible to obtain openings which are accurately positioned and which are formed without cracks in the adjacent portions of the block. Cracks might occur if the openings were clipped out of a block cast without openings into its passages.

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Cores of suitable shapes can be mounted on or between formers for moulding any required openings in the blocks. For example, a frusto-conical core is mounted on a former forming a passage between the ends of a block to form the opening in the second block of Figure 3; the assemblies shown in Figure 11 are extended when the gaps shown in Figure 4 are required.

The formers and cores may be formed with projections and recesses to locate the cores on the formers.

Where the block is to form a wall on which beams are to be supported, a region of additional strength is provided by locating the formers with their hexagonal sectional portions a suitable distance from the second side shutter 52, with a portion of the rod 57 extending between the end of the former and the side shutter 52. The portion of each rod 57 is sheathed by a rubber tube when being used as a former. For additional strength certain formers may be omitted, so that the block is cast without those passages, or certain passages may be filled with concrete after casting.

For blocks having passages at six inch centres, a reinforcing grid 63 of quarter inch diameter mild steel rods at six inch by fifteen inch centres is suitable.

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2. A mould as claimed in claim 1, wherein said parallel elements are connected together by links pivoted to said elements in such a manner that the links can be rotated to alter the distance between said elements.

3. A mould as claimed in claim 2, wherein said links are disposed parallel to each other.

4. A mould as claimed in any of claims 1 to 3 wherein each element is disposed adjacent the junction between a lengthwise-extending side edge of one of the channel section members and the adjacent lengthwise-extending side edge of the other of the members, the element being shaped to bridge the gap between those side edges as the channel-section members are separated.

5. A mould as claimed in claim 4, wherein each of said elements is wedge-shaped at its face which engages said side edges, so as to push the members apart to expand the former.

6. A mould as claimed in any of claims 1 to 5, wherein the former or at least one of the formers has mounted externally thereon one or more core members for forming an aperture or apertures opening to the passage formed by the former.

7. A mould as claimed in any of claims 1 to 6, wherein the former or formers is or are located in holes in the frame and can be inserted and removed through said holes.

8. A mould as claimed in claim 7 wherein the or each former is located at one end in said holes and has its other end engaged by a rod mounted on a sidewall of the frame which rod projects lengthwise of the former.

9. A mould as claimed in any of claims 1 to 8, wherein a plurality of said formers



are provided and are disposed parallel to each other across the frame.

5 10. A method of casting a block with one or more passages therein comprising pouring material which is capable of setting into a mould as claimed in any of claims 1 to 9  
10 positioned on a horizontal floor, allowing the material to set, and then removing the frame, collapsing and removing the former or formers and removing, where provided, the core member or members.

15 11. A method as claimed in claim 10, wherein steel reinforcing elements are disposed in the frame before the material is poured into the mould.

12. A method as claimed in claim 11, wherein the reinforcing elements comprise elements looped around the former or formers.

20 13. A method as claimed in any of claims 10 to 12, wherein there is fixed across the frame a core member which has one face shaped to fit part of the contour of a former and which is constructed and arranged so as to be removably disposed in a face or edge  
25 of the finished block, said member having its one face closely engaging said part of the contour of the former.

14. A method as claimed in any of claims 10 to 13, wherein there is fixed across the frame a member which is disposed between two parallel formers and having opposite faces thereof shaped to fit snugly against the adjacent faces of the two formers. 30

15. A method as claimed in claim 14 wherein said member fixed across the frame divides the space within the frame to enable a plurality of blocks to be cast simultaneously. 35

16. A method of casting blocks which method is substantially as hereinbefore described with reference to and as illustrated in Figures 5 to 9, or in Figures 5 to 10, or in Figures 5 to 9 and Figure 11. 40

17. A mould for casting concrete blocks which mould is substantially as hereinbefore described with reference to and as illustrated in Figures 5 to 9, or in Figures 5 to 10, or in Figures 5 to 9 and Figure 11. 45

18. A block when cast in a mould as claimed in any of claims 1 to 9 or claim 17 or by the method claimed in any of claims 10 to 16. 50

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